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A matheuristic for the driver scheduling problem with staff cars

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Abstract

In the public bus transport industry, it is estimated that the cost of a driver schedule accounts for approximately 60% of a transport company's operational expenses. Hence, it is important for transport companies to minimize the overall cost of driver schedules. A duty is defined as the work of a driver for a day and the driver scheduling problem (DSP) is concerned with finding an optimal set of driver duties to cover a set of timetabled bus trips. Numerous labor regulations and other practical conditions enforce drivers to travel within the city network to designated bus stops to start/end duty, to take a break or to takeover a bus from another driver. This paper focuses on the driver scheduling problem with staff cars (DSPSC), where staff cars can be utilized by the drivers to fulfill their travel activities. However, staff cars should always be returned to the depot and can perform multiple round trips during the day. The problem is restricted by the number of cars available at the depot. We present a matheuristic for solving the DSPSC and the proposed method is tested on instances from Danish and Swedish companies. A comparison with a state-of-the-art mixed integer programming (MIP) solver indicates that the matheuristic provides better solutions, with comparable computation times, for 6 out of 10 large instances. For instances that have more than 6 staff cars and 1200 bus trips, the improvement is 13-15% on average.